

Purpose

- Improve the efficiency of the existing regional freeway and transit networks;
- Reduce congestion on local arterials adversely affected due to accommodating regional traffic volumes;
- Minimize environmental impacts related to mobile sources

- Capacity, Transportation Demand, and Safety
 - Lack of north-south transportation facilities and overall congestion within the region
- Modal Interrelationships and System Linkages
 - SR 110 and I-710 terminate within the study area without connecting to other freeways
- Social Demands or Economic Development
 - SR 710 is included in the SCAG 2012 RTP/SCS, FTIP and Metro's LRTP
- Environmental Factors
 - Effects related to mobile sources associated with congestion

The graph shows travel speed trends for Southbound I-5. The y-axis represents Travel Speed in miles per hour, ranging from 0 to 80. The x-axis represents Interchanges along Southbound I-5, with labels for 10, 15, 20, 25, and 30. Three data series are plotted: Maximum Speed (yellow line), Average Speed (red line), and Minimum Speed (green line). All three series show a general upward trend as the interchange number increases, with a notable peak around interchange 10. An arrow at the top right indicates the 'Direction of Traffic' pointing left, towards lower interchange numbers.

Interchange	Maximum Speed (mph)	Average Speed (mph)	Minimum Speed (mph)
10	75	65	55
15	70	60	50
20	75	65	55
25	70	60	50
30	75	65	55

- Freeway speeds are low and highly variable in LA County
- The graph shows variability in speed along I-5



SR 710 North Study Area

LOS Category	Percentage
LOS C or better	40%
LOS D	23%
LOS E or F	37%

-
- | LOS Category | Percentage |
|-----------------|------------|
| LOS C or better | 53% |
| LOS D | 24% |
| LOS E or F | 23% |



- The heaviest traffic (thick red lines) is almost all on north-south streets
- The volume of traffic will further increase by 2035

- “Cut-Through Traffic” uses local streets for longer trips
- Trips that both started and ended outside the study area were counted as “cut-through”
- The analysis looked at traffic on 13 locations (see map) from LA to Duarte
- About 1 in 8 trips is cut-through
- Cut-through traffic will increase 15% by 2035

- Transit travel times are high - even for relatively short trips
- The map shows travel times on transit to Pasadena
- The red areas are reasonably close to Pasadena but still can take 30 to 60 minutes or more on transit

Alternatives Overview

1. No Build

The No Build Alternative includes transportation improvement projects inside and outside the Study Area, including all projects in the Southern California Association of Governments (SCAG) Regional Transportation Plan (RTP) programmed to be completed by 2035. Including these projects is required by state and federal laws to demonstrate that the SR 710 North Study need still exists even if these projects are completed. For detailed information on proposed projects under the SCAG RTP, go to <http://rtpsc.scag.ca.gov>.



2. Transportation System Management/ Transportation Demand Management (TSM/TDM)

ITS Improvements



- Signal synchronization
- Signal optimization
- Transit signal priority
- Arterial changeable message signs
- Speed data collection system

Local Street and Intersection Improvements



- 17 intersection improvements
- 7 local street segments
- Modify Fair Oaks/SR 110 Interchange
- Extend St. John from Del Mar to California Valley to Mission Connector

Transit Refinement



- Expanded peak period existing bus service
- 10 minutes headway during peak hours

Active Transportation



- Pedestrian and bike facility enhancements to support access to transit
- Consistent with local agency plans

- Preliminary Cost Estimate: \$105 M (in 2014 dollars)

3. Bus Rapid Transit (BRT)

- High-speed, high-frequency service between East Los Angeles and Pasadena
- 12-mile corridor; 17 stops
- Mixed-flow and exclusive lanes (single and both directions)
- 10 minutes during peak hours and 20 minutes during off-peak
- Replaces existing Route 762
- Amenities included to attract riders
- Two bus feeder services
 - Connects to El Monte Bus Station
 - Connects to Commerce and Montebello Metrolink Stations
- Preliminary Cost Estimate: \$241 M (2014 dollars)
 - Includes \$102 M for TSM/TDM improvements



4. Light Rail Transit (LRT)

- Between East Los Angeles and Pasadena
- 7.5-mile passenger rail line on dedicated guideway
 - Includes 3 miles of aerial segment and 4.5 miles of tunnels
 - 3 aerial and 4 underground stations
- The tunnels are expected to be constructed using pressurized-face Tunnel Boring Machines (TBMs)
 - Two approximately 20-foot diameter tunnels
 - Tunnels would be advanced from south end
- Design including safety elements follows Metro guidelines
- Two bus feeder services
 - Connects to El Monte Bus Station
 - Connects to Commerce and Montebello Metrolink Stations
- Preliminary Cost Estimate: \$2,420 M (2014 dollars)
 - Includes \$52 M for TSM/TDM improvements



5. Freeway Tunnel

- 6.3-mile route connecting I-10 and I-210
 - 4.2 miles of bored tunnel
 - 0.7 mile of cut-and-cover tunnel
 - 1.4 miles of at-grade segments
 - Approximately 60-foot tunnel diameter(s)
- The tunnels are expected to be constructed using pressurized-face TBMs
- Design and safety elements based on Caltrans and National Fire Protection Association guidelines
- Ventilation structures provided near north and south portals
 - No intermediate ventilation structures
- Operations and Maintenance Control (OMC) Building provided at both portals
 - Will house first responders 24/7
- Preliminary Cost Estimate:
 - Single Bore: \$3,150 M (2014 dollars)
 - Dual Bore: \$5,650 M (2014 dollars)
 - Includes \$50 M for TSM/TDM elements



Tunnel Design Considerations

Global Large Diameter Tunnels

Many large-diameter tunnels have been excavated successfully around the world. Many of these shown have used similar tunneling and excavation technologies as those proposed on the tunnels being considered in this study.

Tunnel Name	Country	Approximate Diameter (feet)
Brisbane Legacy Way	Australia, Brisbane	40
Brisbane Clem Jones Tunnel	Australia, Brisbane	40
Brisbane Airport Link East-West Tunnel	Australia, Brisbane	41
Yeni Lozan Iron Valley Railway	Austria, Manners	43
Peruchling	Austria, Vienna	43
Niagara Tunnel	Canada, Ontario	47
Zhangjiang Under River Tunnel	China, Hangzhou	51
Guangzhou-Shenzhen-Hong Kong Express Rail Link	China, Hong Kong	43
Jingling II Hydropower Station Tunnels	China, Jinling	41
Nanjing Yangtze River Crossing	China, Nanjing	49
Weslan Road Tunnel	China, Nanjing	49
Bund Tunnel	China, Shanghai	47
Yongnian Road Tunnel	China, Shanghai	47
Shangdong Road Subaqueous Tunnel	China, Shanghai	49
Jiangong Road Subaqueous Tunnel	China, Shanghai	49
Hongmiao Road Tunnel	China, Shanghai	49
Shanghai Changjiang/Chongming Yangtze River Tunnel	China, Shanghai	51
Wu-Erlan River Tunnel	Germany, Hamburg	47
Calleria Sponzo	Italy, Sponzo	51
Mabugna Trento Nord	Italy, Trento	40
Trans Tokyo Bay Highway Tunnel	Japan, Tokyo	46
Tokyo Metro	Japan, Tokyo	47
Stormwater Management and Road Tunnel (SAMRT)	Malaysia, Kuala Lumpur	43
Groene Hart Tunnel	Netherlands	49
Waterview Connection Auckland	New Zealand, Auckland	47
Rowacki Tunnel Gdansk	Poland, Gdansk	41
Silver Forest Tunnel (Silberwald)	Russia, Moscow	47



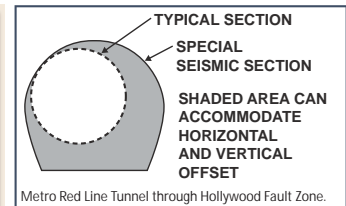
Tunnel Name	Country	Approximate Diameter (feet)
Sochi Road Tunnel No. 3	Russia, Sochi	43
Barcelona Metro Line 9	Spain, Barcelona	40
Tuneles Urbanos de Girona	Spain, Girona	40
M-30 By Pass Sur Tunnel Norte	Spain, Madrid	50
Soville SE-40 Highway Tunnels	Spain, Soville	46
Adler Tunnel	Switzerland, Basel	41
Blod East Branch	Switzerland, Biel	41
Tunnel du Bure	Switzerland, Bure	41
Zurich-Thalwil Zimmerberg Base Tunnel	Switzerland, Zurich	40
Erdemir Kocaeli / Tunnel 26	Turkey, Baskoy	45
Istanbul Strait Road Tube Crossing	Turkey, Istanbul	45
Port of Miami Tunnel	USA, Miami	42

Fault Crossing Concepts

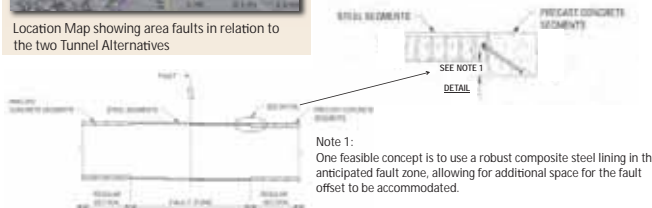
The LRT and Freeway tunnel alternatives cross potentially active faults. Depending on the magnitude of fault offset, there are various approaches to address fault crossing design such as utilizing an oversize vault or a flexible lining to accommodate expected fault offset/movement. A similar approach was used on Metro's Red Line tunnels traversing the Hollywood Fault in the Hollywood Hills.



Location Map showing area faults in relation to the two Tunnel Alternatives



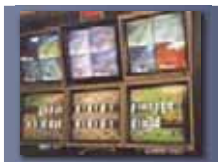
Metro Red Line Tunnel through Hollywood Fault Zone.



Note 1: One feasible concept is to use a robust composite steel lining in the anticipated fault zone, allowing for additional space for the fault offset to be accommodated.

Tunnel Systems & Fire Life Safety Considerations

The Tunnel Systems Fire Life Safety (FLS) components in both the Freeway and LRT Alternatives will comply with all federal, state and local requirements including but not limited to the National Fire Protection Association Codes 101, 130 and 502 as well as Caltrans and Metro standards. These systems are installed to provide convenient and safe operation of the tunnel environment, especially for fire protection in case of emergencies. Some examples of the tunnel systems as well as the FLS considerations are shown below.



Operations and Maintenance Control (OMC) Buildings and Communication Systems

- Co-location of first responders
- Voice communication: phone, radio, public address system
- Traffic detection (Freeway Alt)
- Train location (LRT Alt)
- Lighting



Ventilation System

- Jet fans
- Exhaust fans
- Air filtering
- Air monitoring
- Fire detection and suppression system

Fire Life Safety Systems

- Fixed fire fighting system
- Standpipes and hoses
- Fire extinguishers



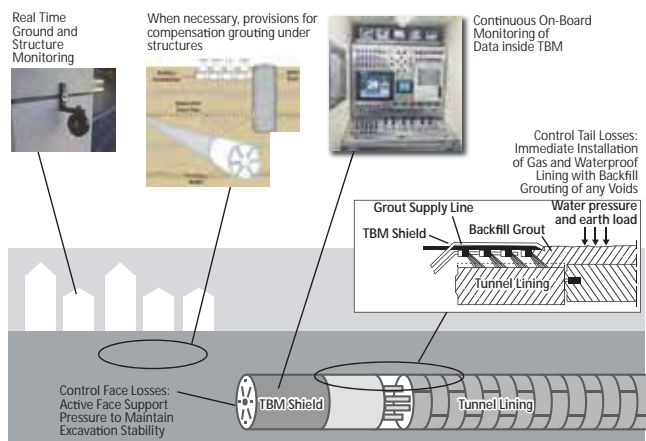
Emergency Exits/Evacuation

- Emergency egress walkways
- Motorist/passenger aid station
- Cross passages (LRT and Dual Bore only)



Settlement Control

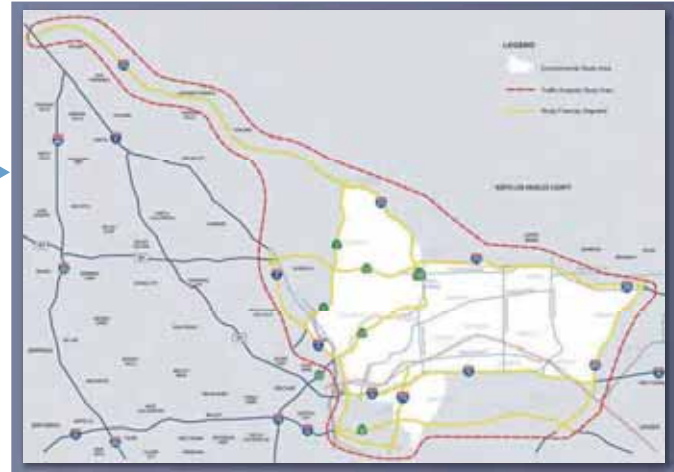
Pressurized-face Tunnel Boring Machines (TBMs) are routinely used to reduce the risk of ground loss during excavation. These TBMs provide active ground control at the face of the excavation, which controls face losses. To control shield losses, pressure can be maintained over the length of the shield by injecting bentonite grout. Backfill grout injected into the annular space between the excavated ground and the lining will control tail losses. Active real-time monitoring consisting of an onboard monitoring system as well as geotechnical instrumentation is typically used to monitor ground movements during excavation. If necessary, additional mitigation measures may be required such as compensation grouting to control settlement.



Traffic Analysis Overview

Multiple Traffic Analysis Study Areas

- Regional (6 counties - Riverside, Imperial, Los Angeles, San Bernardino, Orange, Ventura)
- EIR/EIS Study Area
- Northeast LA County Freeway Network
 - over 600 segments
 - beyond the EIR/EIS Study Area
- Intersections
 - 156 high-volume locations
 - focused on alternative footprints and affected areas



Two Types of Traffic Analysis

Regional and Study Area Patterns (Travel Forecasting)

System

- VMT
- Travel time
- Throughput
- Throughput (arterial and freeway)
- Employment accessibility

Highway

- Volume served
- Traffic diversion to local arterials
- Use of arterials for long trips
- Travel time improvement

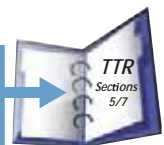
Transit

- New transit trips
- Transit mode share
- North-south transit throughput
- Transit accessibility



Freeway and Intersection Impact Analysis (Traffic Operations Analysis)

- Level of Service (LOS), delay (intersections) and volume (freeway segments)
- Defined criteria (2 to 5 seconds more delay, 2% more volume)

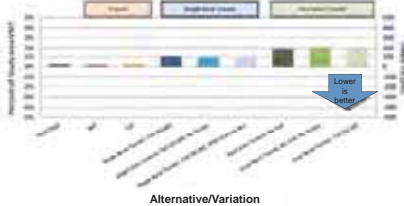


Comparison of Alternatives: Travel Forecasting

VMT/VHT

Change in VMT (Study Area) vs. 2035 No Build

Additional roadway capacity attracts traffic from local streets (served by freeways).

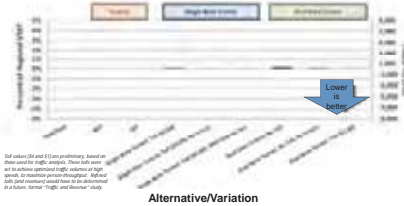


Alternative/Variation

Vehicle Miles Traveled (VMT) is the total of all vehicle trips on all roads in the area of interest. It captures the total amount of travel by cars, trucks, and other vehicles on the road. It is important for assessing traffic, air quality, noise, and energy impacts.

Change in VMT (Region) 2035 No Build

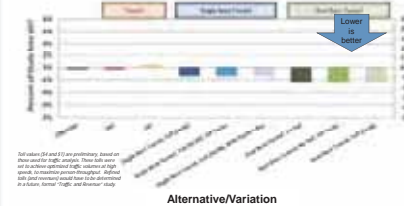
Regional VMT changes are near zero, as traffic is redistributed.



Alternative/Variation

Change in VHT (Study Area) vs. 2035 No Build

Study area travel time (VHT) drops as more roadway capacity is added, even though VMT increases.



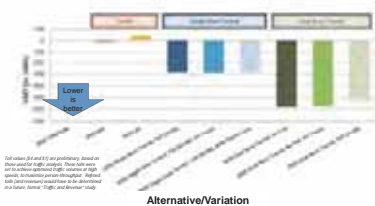
Alternative/Variation

Vehicle Hours Traveled (VHT) is the total time spent on the road by vehicles on all roads in the area of interest. It captures the time spent by the drivers (not passengers) of cars and trucks. It is important for assessing traffic, air quality, noise, and energy impacts.

Arterials

Change in Arterial VMT (Study Area) vs. 2035 No Build

Arterial VMT is reduced when freeway capacity is increased.

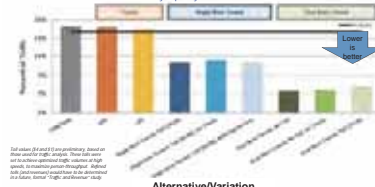


Alternative/Variation

Vehicle Miles Traveled (VMT) is the total of all vehicle trips on all roads in the area of interest. It captures the total amount of travel by cars, trucks, and other vehicles on the road. It is important for assessing traffic, air quality, noise, and energy impacts.

Use of Study Area Arterials for Long Trips

The percent of long (cut-through) trips on local streets is reduced up to half when freeway capacity is increased.



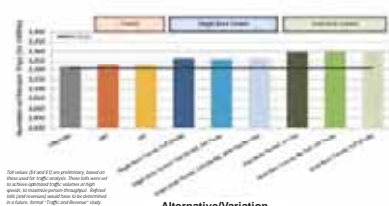
Alternative/Variation

The traffic model was used to estimate how many "long trips" in the study area are cutting through on arterials (local streets in Alhambra, South Pasadena, and Pasadena). "Long trips" both start and end outside of the study area.

North-South Travel

Person Trips Passing East-West Screenline

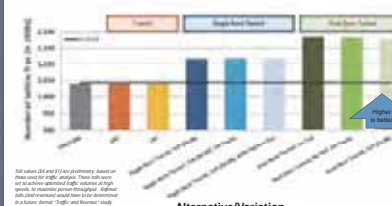
All alternatives serve more north-south travel.



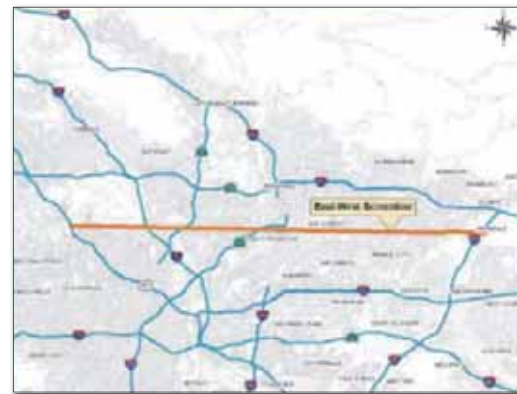
Alternative/Variation

Volume Crossing Screenline (Freeways)

Additional freeway capacity serves more vehicle trips.



Alternative/Variation

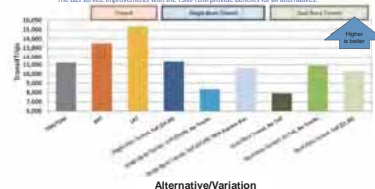


The Project Purpose and Need focuses on north-south travel in the SR 710 corridor. To assess north-south travel, the model used a defined east-west screenline, illustrated in the map below. The graphs around the map provide data on the number of person trips (in cars and transit vehicles), traffic volumes, and transit passengers crossing the screenline.

Transit

Change in Linked Transit Trips (Study Area) vs. 2035 No Build

Linked transit trips (a measure of additional use of transit) is highest for the LRT. The bus service improvements with the TSM/TDM provide benefits for all alternatives.

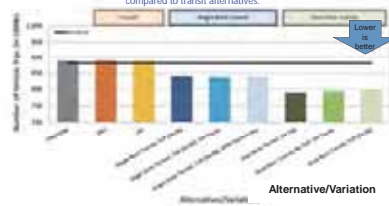


Alternative/Variation

"Linked transit trips" is the way to determine the additional number of new transit riders – people who elect to use transit services instead of another way to travel.

Volume Crossing Screenline (Arterials)

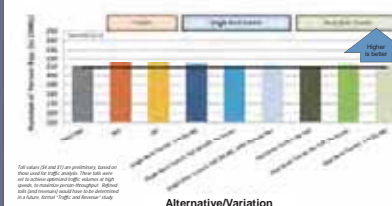
Arterial traffic volume is reduced with the freeway tunnel compared to transit alternatives.



Alternative/Variation

Transit Travel Across the Screenline

North-south transit travel in the study area is approximately the same for all alternatives.



Alternative/Variation

Key Findings - Community Impact Assessment

Land Use

All Build Alternatives:

- Inconsistent with policies, objectives, or program goals of various General Plans; amendments required

De minimis Section 4(f) impacts at Cascades Park (BRT Alternative only):

- Permanent acquisition of ~0.011 acres



Cascades Park - Monterey Park

Community Character and Cohesion

LRT Alternative

- Adverse impacts to community character and cohesion from the displacement of 15 neighborhood-oriented businesses along Mednik Avenue

TSM/TDM, BRT, and Freeway Tunnel (Single and Dual-Bore) Alternatives

- No adverse impacts to community character and cohesion

Environmental Justice

- No disproportionate impacts on environmental justice populations

Growth

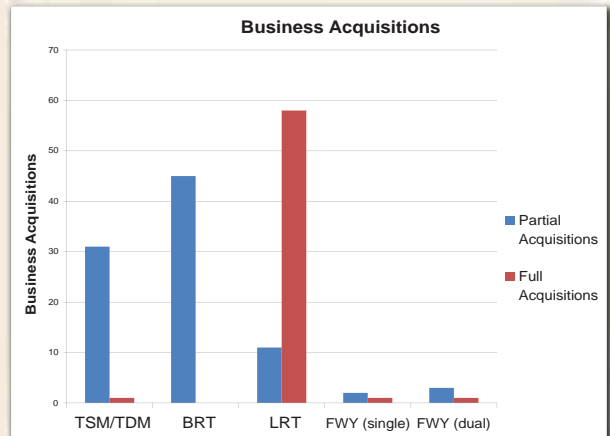
The Build Alternatives are not expected to result in unplanned growth:

- The study area is largely built out
- No new access to undeveloped or underdeveloped areas

Property Acquisition

All Build Alternatives:

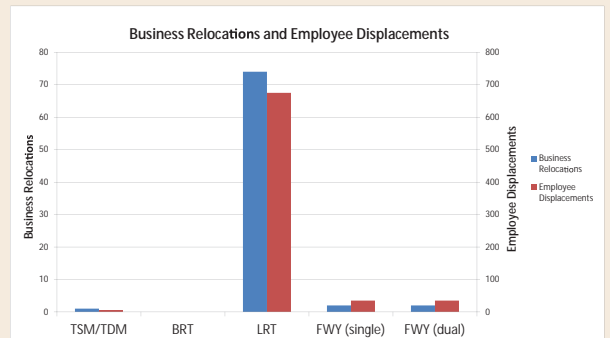
- No residential acquisitions would be required



Relocations and Displacements

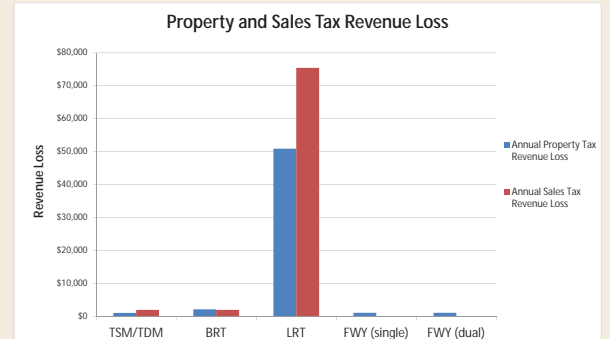
All Build Alternatives:

- No residential relocations or displacements would be required



Property and Sales Tax

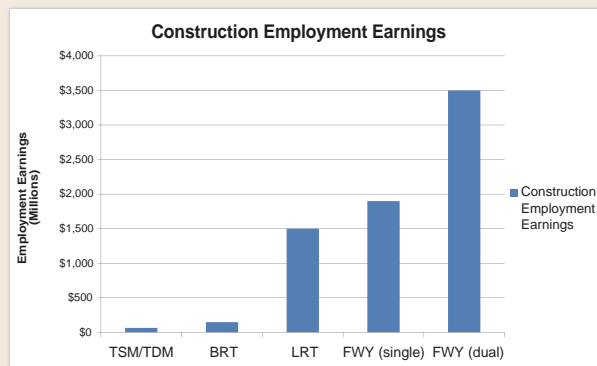
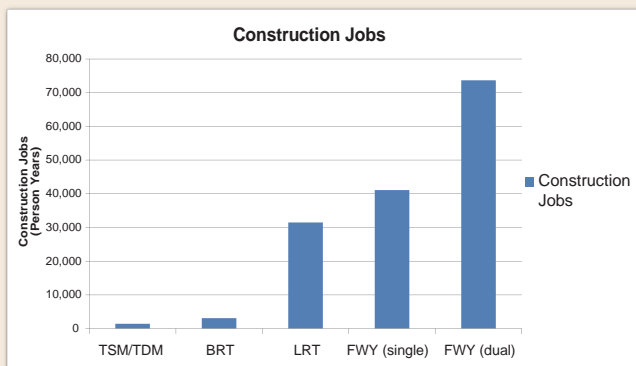
Property or sales tax losses would occur as a result of property acquisitions or relocations. The approximate property and sales tax losses of the Build Alternatives are displayed below:



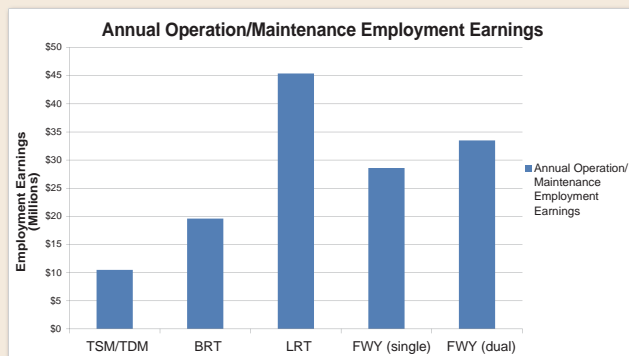
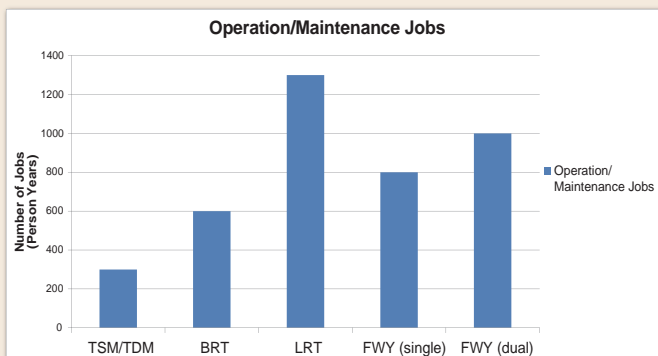
Key Findings - Community Impact Assessment

Employment / Fiscal Impacts

Construction of the Build Alternatives would result in the creation of construction jobs and the generation of employment earnings:

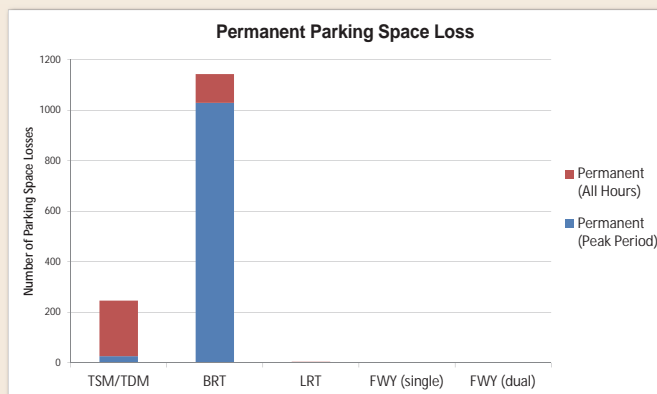
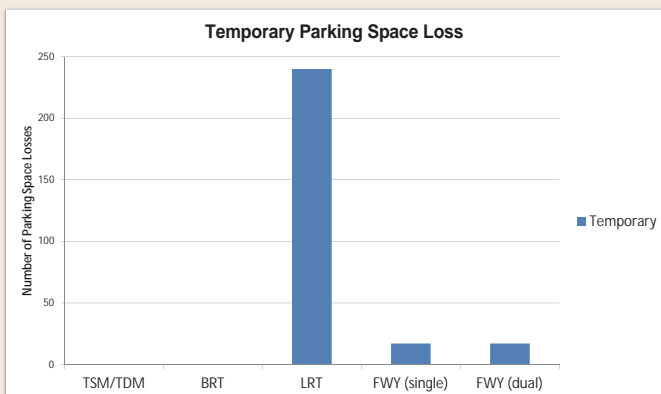


The operation and maintenance of the Build Alternatives would result in the creation of jobs and the generation of annual employment earnings:



Parking Impacts

The potential temporary and permanent parking losses for each of the Build Alternatives are displayed below:



Key Findings - Visual, Noise and Vibration

Visual

TSM/TDM Alternative:

- Minor physical changes or visible impacts to the environment
- A minimal increase in lighting in existing business and residential areas
- Limited changes in glare from changes in traffic control cycles and additional travel lanes
- No shade or shadow effects
- Approximately seven recommended noise barriers that may result in a low to high visual impact

LRT Alternative:

- Noise barriers may result in a low to moderate visual impact
- Moderately low permanent visual impacts on key views
- Low permanent impacts related to light, glare, and shade and shadows

BRT Alternative:

- Minimal increase in lighting and glare
- Minor new shade and shadow effects at new bus stops and signage
- Low permanent visual impacts on key views
- Approximately three recommended noise barriers may result in a moderate to moderately high visual impact

Freeway Tunnel Alternative:

- Moderately low to moderate visual impacts on key views
- Minimal vehicle headlight glare from new non-tunnel segments built below the existing grade level
- Minimal shade and shadow impacts
- Approximately five recommended noise barriers for the dual-bore design variation may result in moderate to high visual impacts
- Approximately three recommended noise barriers for the single-bore design variation may result in moderate to high visual impacts

Visual Simulations



Proposed Bus Rapid Transit (BRT) Lane at 245 Fair Oaks Avenue in South Pasadena



Light Rail Transit crossing the I-10 Freeway



LRT maintenance yard at Valley Blvd.



Freeway Tunnel proposed northern portal



Freeway Tunnel proposed southern portal

See display maps for exhibits of visual simulations.

Noise

- FHWA Noise Abatement Criteria (NAC) and FTA Criteria used to determine when a noise effect would occur

Receptors approaching and exceeding NAC or FTA criteria prior to abatement:

- 27 receptors (TSM/TDM Alternative)
- 9 receptors (BRT Alternative)
- 12 moderate impact receptors (LRT Alternative)
- 5 severe impact receptors (LRT Alternative)
- 66 receptors (Freeway Tunnel Alternative [Single-Bore])
- 75 receptors (Freeway Tunnel Alternative [Dual-Bore])

Ground-borne Noise and Vibration

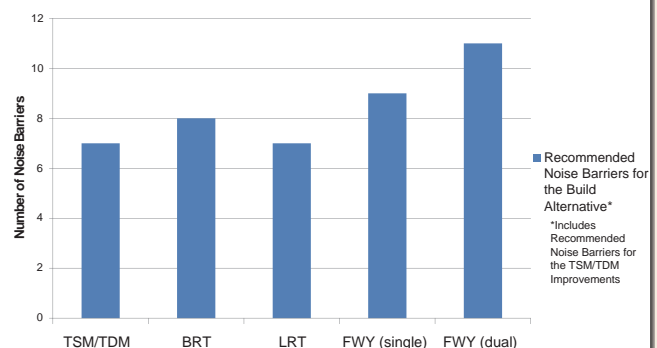
LRT Alternative:

- Potential operational ground-borne noise and vibration impacts to 450 residential buildings and 1 commercial office building
- No ground-borne noise and vibration impacts with implementation of standard vibration control measures

Other Alternatives:

- No impacts associated with ground-borne noise and vibration from the operation of the other Build Alternatives

Recommended Noise Barriers



See display maps for locations of recommended noise barriers.

Key Findings - Cultural Resources and Paleontology

Cultural Resources

**2,220 properties in project Area of Potential Effects (APE);
73 are listed on or eligible for the National Register:**

TSM/TDM Alternative: 11 historic properties evaluated

- No adverse effect

BRT Alternative: 17 historic properties evaluated

- No adverse effect

LRT Alternative: 17 historic properties evaluated

- No adverse effect

**Freeway Tunnel Alternatives (Single and Dual-Bore):
51 historic properties evaluated**

- No adverse effect



Rialto Theater, South Pasadena



330 S. Fair Oaks, Pasadena



Sequoia School, Pasadena



4777 S. Cesar Chavez, Los Angeles



Visual Simulation: LRT Alternative Alignment near
4777 Cesar E. Chavez Avenue



Visual Simulation: BRT Alternative Improvements
near the Oaklawn Bridge and Waiting Station on
Fair Oaks Avenue

Paleontology

All earth-moving operations could result in the loss of fossil remains and rock formations within the construction disturbance limits. The loss of paleontological resources depending on the type of TBM used would be considered a permanent, significant, unavoidable impact for tunnel boring operations associated with the LRT and Freeway Tunnel Alternatives based on the scientific significance of the formations in the study area.

TSM/TDM and BRT Alternatives

- Minor ground disturbance
- Previously disturbed; likely underlain by artificial fill

LRT and Freeway Tunnel Alternatives (Single and Dual-Bore):

- Fossil recovery during excavation and grading, cut/cover tunnel stations
- Fossil recovery during tunnel boring would be limited



Key Findings - Natural Environment Study

Natural Communities

TSM/TDM, BRT, and LRT Alternatives:

- No permanent impacts on sensitive natural communities

Freeway Tunnel Alternative:

- Permanent direct impacts to ~1.09 acres of riparian habitat

Animal Species

All Build Alternatives:

- Disturbed/developed community
 - Potential suitable habitat for the San Bernardino ring-necked snake

TSM/TDM, BRT, and Freeway Tunnel (Single and Dual-Bore) Alternatives:

- Nonnative grasslands
 - Potential habitat for milkweed plants required for monarch butterfly breeding
 - Potential suitable habitat for western spadefoot toad and San Bernardino ring-necked snake

LRT and Freeway Tunnel (Single and Dual-Bore) Alternatives:

- Nonnative woodlands (LRT and Freeway Tunnel)
 - Potential to contain eucalyptus trees with winter roosting aggregations of adult monarch butterflies

Plant Species

	TSM/ TDM	BRT	LRT	Freeway Tunnel (Single and Dual-Bore)
Trees protected by local tree ordinances	No impact	136 removed	21 removed	84 removed
Southern California black walnut	No impact	No impact	No impact	Permanent impact to 1 tree located ~4 feet from the permanent impact area
Impacts to one Coulter's goldfields population	No impact	No impact	Indirect permanent edge effects	Permanent direct impacts



Townsend's big-eared bats



San Bernardino ring-necked snake

Wetlands

TSM/TDM, BRT, and LRT Alternatives:

- No impacts to wetlands or other waters

Freeway Tunnel Alternative impacts to non-wetland waters:

- ~0.06 acres of permanent impacts (single-bore)
- ~0.5 acres of permanent impacts (dual-bore)

Threatened and Endangered Species

All Build Alternatives:

- Townsend's big-eared bats
 - Temporary indirect impacts through habitat loss at bridge widenings
 - Temporary indirect impacts to foraging bats during nighttime construction

LRT and Freeway Tunnel (Single and Dual-Bore) Alternatives:

- Riparian obligate bird species
 - Limited indirect temporary impacts due to proximity of potential nonbreeding riparian habitat to construction activities



Riparian system under overpass



Del Mar Pump Station

Key Findings - Floodplains, Water Quality, Energy, Hazardous Waste, Geology and Soils

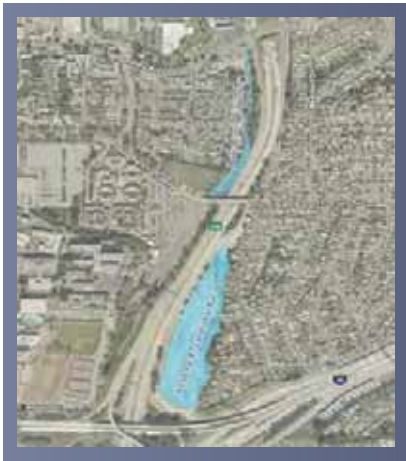
Floodplains

TSM/TDM, BRT, and LRT Alternatives:

- No floodplain encroachments

Freeway Tunnel Alternative:

- Encroachment in the Laguna Regulating Basin floodplain (Single and Dual-Bore)
 - Nominal reduction of the floodplain boundary
 - No increase in water surface elevation
- Encroachment in the Dorchester Channel floodplain (Dual-Bore)
 - Nominal reduction of the floodplain boundary
 - Minor increase in water surface elevation



Hazardous Waste

All of the Build Alternatives would potentially:

- Encounter hazardous materials during disturbance of soils and demolition of existing structures
- Result in impacts from hazardous materials associated with a number of properties that require Phase II Site Investigations



Water Quality

	TSM/TDM	BRT	LRT	Freeway Tunnel	
				Single-bore	Dual-bore
Increase in impervious surface	3.8 ac	1.12 ac	16.5 ac	1.7 ac	13.5 ac
Area treated by BMPs	12.0 ac	37.0 ac	16.5 ac	90.0 ac	95.0 ac

ac=acres

Energy

Compared to 2035 No Build Condition in study area:

TSM/TDM Alternative

- Operation: No change
- Maintenance: 0.3% increase

BRT Alternative

- Operation: No change
- Maintenance: 0.3% increase

LRT Alternative

- Operation: 0.7% decrease
- Maintenance: 0.2% increase

Freeway Tunnel Alternative

- Operation: 0.7-1.0% decrease (Single-Bore)
- Operation: No Change (Dual-Bore)
- Maintenance: 0.6-1.6% increase (Single and Dual-Bore)

Subject Property No.	Facility	Alternative(s) Affected
1	Former Circle K Stores	BRT
2	Fashion Master Cleaners	BRT, LRT, TSM/TDM (I-10)
3	Railroad ROW	TSM/TDM (Other Road Improvement T-1)
4	Elite Cleaners	BRT, LRT
5	Blanchard Landfill	LRT
6	Mercury Die/ Mission Corrugated	LRT, Freeway Tunnel (Single and Dual-Bore), TSM/TDM (Other Road Improvement T-1)

Geology and Soils

	TSM/TDM	BRT	LRT	Freeway Tunnel
Potential for naturally occurring oil or gas encountered during construction	Low Potential	Low Potential	Low to Moderate Potential	Low to Moderate Potential
Potential to experience fault rupture, seismically-induced ground motion, liquefaction, and/or landslides	Yes	Yes	Yes	Yes
Potential for ground settlement and differential settlement above and adjacent to tunnel	N/A	N/A	Low Potential	Low Potential

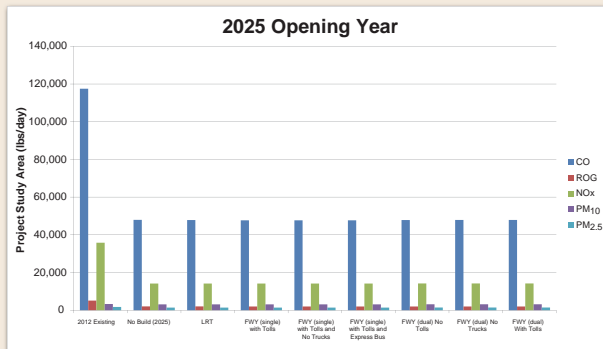
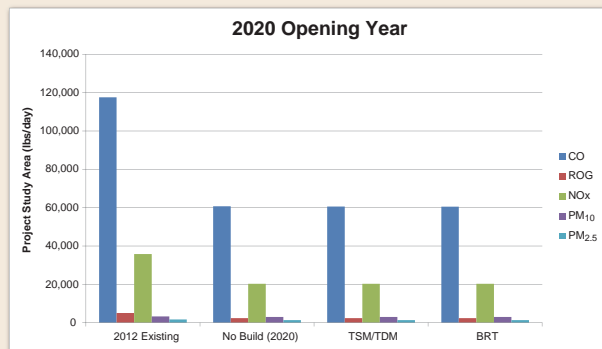
Key Findings - Air Quality

Air Quality

2020/2025 Opening Year

- The regional criteria pollutant emissions for the No Build and all of the Build Alternatives are lower than the Existing (2012) condition emissions. The reduction ranges from 4 percent for PM₁₀ to 59 percent for carbon monoxide (CO).
- When compared to the 2020/2025 No Build conditions, the change in regional criteria pollutant emission is very small. The change in emission ranges from decrease of 1.9 percent for reactive organic gases (ROG) to an increase of 1.4 percent for PM₁₀.

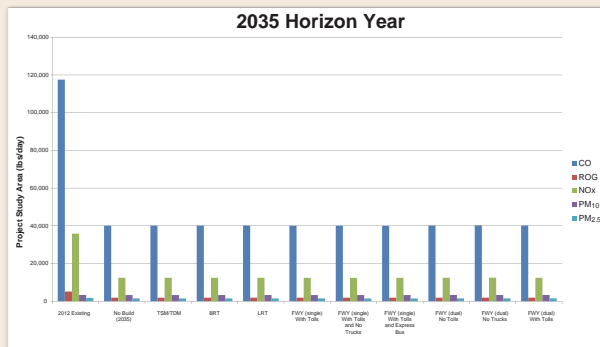
2020/2025 Opening Year



2035 Horizon Year

- With the exception of PM₁₀ for the dual-bore tunnel alternative variations, the regional criteria pollutant emissions for the No Build and all of the Build Alternatives are lower than the Existing (2012) condition emissions. The reduction ranges from 0.6 percent for PM₁₀ to 66 percent for CO. The largest increase in PM₁₀ is 0.3 percent.
- When compared to the 2035 No Build conditions the change in regional criteria pollutant emission is very small. The change in emissions ranges from a decrease of 1.7 percent for ROG to an increase of 1.7 percent for PM₁₀.

2035 Horizon Year



Transportation Conformity

- The Build Alternatives would not result in any exceedance of the 1-hour or 8-hour CO standards
- The maximum PM_{2.5} and PM₁₀ concentrations within the project area are associated with the No Build Alternatives
- Through interagency consultation, the TSM/TDM, LRT, and BRT Alternatives were determined not to be Projects of Air Quality Concern (POAQC)
- Additional PM analyses will be conducted for the Freeway Tunnel Alternative if it is identified as the preferred alternative

Key Findings - Health Risk Assessment and Climate Change

Health Risk Assessment

Build and No Build Alternatives vs. Existing Condition

Existing conditions:

- Cancer risk estimated about 100 in a million near most highways/principal arterials
- Cancer risk estimated over 250 in a million near I-210 (east of SR 710) and I-5.

Decrease of cancer risk in the study area for all alternatives compared to existing conditions

- Reduction in cancer risks within the study area on local arterials
- Higher reduction adjacent to freeways compared to existing conditions
- Decrease attributed to stringent emission standards, cleaner fleets, improved fuel efficiency, shifting of traffic for each of the build alternatives, etc.

Locations with greater existing vehicle volumes will have greater expected cancer risk reduction in future years

The overall regional reduction of cancer risks considers emissions from the ventilation structures

- Particulate matter emissions are substantially reduced by scrubbing and dispersion

Build Alternatives vs. No Build Alternatives

Build vs No Build Cancer Risk Impact Overview

- Overall regional benefits of cancer risk reduction
- Localized cancer risk increases in small areas

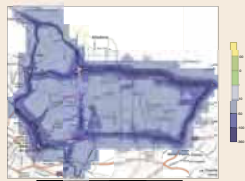
TSM/TDM, BRT, and LRT:

- Overall cancer risk reduction in majority of the project area
- Localized cancer risk increases at scattered locations depending on shifting of vehicle travel routes

Freeway Tunnel Alternative and Design Options

- Overall cancer risk reduction in majority of the project area
- Higher levels of cancer risk reduction in the region, especially along major highways, when compared to TSM/TDM, BRT, and LRT
- Localized impacts are mostly near SR 710/I 210 and SR 710/I-10 interchanges and the portals

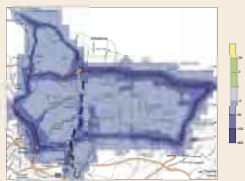
Cancer Risk Reduction Contours: TSM/TDM, BRT, LRT



TSM/TDM Alternative vs. Existing Conditions



BRT Alternative vs. Existing Conditions



LRT Alternative vs. Existing Conditions

Cancer Risk Reduction Contour: No Build vs. Existing Conditions

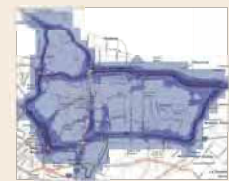


No Build vs. Existing Conditions

Cancer Risk Reduction Contours: Freeway Tunnel (Single and Dual-Bore)



Freeway Tunnel (Single-Bore)
with Express Bus
vs. Existing Conditions



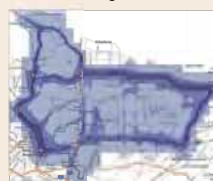
Freeway Tunnel (Single-Bore)
with Toll vs. Existing Conditions



Freeway Tunnel (Single-Bore)
with Toll without trucks
vs. Existing Conditions



Freeway Tunnel (Dual-Bore)
with tolls vs. Existing Conditions



Freeway Tunnel (Dual-Bore)
without tolls vs. Existing Conditions

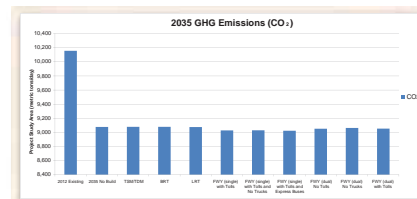


Freeway Tunnel (Dual-Bore)
without tolls without trucks
vs. Existing Conditions

Climate Change

Small decrease in regional carbon dioxide (CO₂) emissions during operation of the Build Alternatives except:

- TSM/TDM Alternative
- BRT Alternative



Key Findings - Construction Impacts

Land Use

All Build Alternatives:

- Construction-related effects on existing land uses
 - Business and neighborhood disruptions
 - Disruption of local traffic patterns
 - Disruption of access to homes and businesses
 - Increased traffic congestion, noise, vibration
- Use of privately owned properties for temporary construction easements (TCEs)

Community Impacts

- Temporary impacts to community character and cohesion from air quality, noise, traffic/access, and/or parking effects to community facilities within 500 feet of the Build Alternatives
- Construction traffic impacts would include minor temporary lane restrictions to overnight closures and detours
- Hauling excavated materials from tunnel boring using freeways and/or rail
 - LRT station excavation would use local streets
- Increase in person-year jobs and employment earnings

Temporary Construction Easements (TCEs):

	TSM/TDM	BRT	LRT	Freeway Tunnel	
				Single-Bore	Dual-Bore
TCEs	16 parcels	36 parcels	13 parcels	52 parcels	47 parcels

Haul Routes



Potential haul routes for the LRT tunnel and station excavations



Potential haul route for the Freeway Tunnel Alternative North Portal (Single and Dual-Bore)

Cultural Resources

Potential for previously undocumented cultural resources or human remains to be unearthed during site preparation, grading, or excavation

Hydrology and Floodplain

Freeway Tunnel Alternative (Single and Dual-Bore):

- Construction activities would encroach in the Laguna Regulating Basin floodplain
- Land and vegetation would be cleared, exposing soil to the potential for erosion and downstream transport of sediments to occur

Freeway Tunnel Alternative (Dual-Bore):

- Construction activities would encroach in the Dorchester Channel floodplain

Geology and Soils/Hydrology

- Low potential for soil settlement
- Potential for naturally occurring gas to be encountered
- Dewatering required for the LRT and Freeway Tunnel (Single and Dual-Bore) Alternatives

Hazardous Waste/Materials

- Potential release of hazardous materials such as lead and asbestos-containing materials (ACMs) during soil disturbance and demolition
- Phase II Site Investigations required for 6 properties

Air Quality

Short-term degradation of air quality may occur due to the release of particulate emissions (airborne dust) from construction activities such as excavation, grading, and hauling

Noise and Vibration

All Build Alternatives:

- Temporary noise and ground-borne vibration impacts associated with construction

LRT and Freeway Tunnel (Single and Dual-Bore) Alternatives:

- Short-term ground-borne noise and vibration from:
 - Tunnel excavation
 - Supply and muck train movements
 - Excavation and construction of tunnel portal and underground stations

Energy

Temporary indirect energy impacts result from the manufacture of vehicles that operate on the project and project construction.

Construction energy in British Thermal Units (BTUs) in billions:

	TSM/TDM	BRT	LRT	Freeway Tunnel	
				Single-Bore	Dual-Bore
BTUs	33,600	55,300	422,000	523,000	926,000

Invasive Species

Construction activities have a potential to spread invasive species